CLAIMS

What is claimed is:

1. A rotary electric motor comprising:

a permanent magnet rotor having a plurality of permanent magnets disposed in an annular ring configuration;

a stator comprising a plurality of separate, ferromagnetically isolated electromagnets in an annular ring configuration, windings of the electromagnets selectively energized to form magnetic poles of alternating polarity along a radial air gap that separates the stator from the rotor; and

a plurality of separate power modules, each of said modules corresponding to a respective stator electromagnet for providing energization current thereto.

2. A rotary electric motor as recited in claim 1, wherein said stator is encompassed within the rotor.

3. A rotary electric motor as recited in claim 1, wherein each of said power modules comprises:

drive circuitry; and

electronic switches connected to a power source and the respective electromagnet, the switches being responsive to drive circuitry for directing current pulses from the power source to a winding of the electromagnet.

4. A rotary electric motor as recited in claim 3, wherein each of said power modules further comprises a circuit board having mounted thereon respective drive circuitry and respective switches.

5. A rotary electric motor as recited in claim 4, further comprising a sequence controller connected to the drive circuitry of each module for applying thereto timing signals.

6. A rotary electric motor as recited in claim 5, further comprising at least one rotor position sensor for providing output signals indicative of rotor position and wherein said sequence controller is responsive to said output signals.

7. A rotary electric motor as recited in claim 3, wherein said power source comprises a plurality of batteries, each of said batteries supplying power to only one of said modules.

8. A rotary electric motor as recited in claim 3, wherein each of said power modules further comprises:

a rotor position sensor for providing output signals indicative of rotor position with relating to the respective power module; and

a sequence controller connected to the drive circuitry and to said rotor position sensor for providing timing signals for controlling the operation of said switches.

9. A rotary electric motor as recited in claim 8, wherein direction of current flow and duration of each current pulse is determined by selected activation of the switches by the drive circuitry.

10. A rotary electric motor as recited in claim 1, wherein the motor is enclosed within a shielded housing thereby to avoid external electromagnetic interference.

11. A rotary electric motor as recited in claim 1, wherein the plurality of separate power modules are contained within the stator radially inward of the stator electromagnets.

12. A rotary electric motor comprising:

a permanent magnet rotor having a plurality of permanent magnets disposed in an annular ring configuration; and

a stator coaxial with the rotor and separated therefrom by an axial air gap;

wherein the stator comprises a plurality of independent stator units, each of the units comprising a ferromagnetically isolated core having a winding formed thereon and circuitry for controlling energization of the winding.

13. A rotary electric motor comprising:

a permanent magnet rotor having a plurality of permanent magnets disposed in an annular ring configuration; and

a stator coaxial with the rotor and separated therefrom by an axial air gap;

wherein the stator comprises a plurality of independent stator units, each of the units comprising a ferromagnetically isolated core having a winding formed thereon and a power supply.

14. A rotary electric motor comprising:

a permanent magnet rotor having a plurality of permanent magnets disposed in an annular ring configuration; and

a stator coaxial with the rotor and separated therefrom by an axial air gap;

wherein the stator comprises a plurality of independent stator units, each of the units comprising a ferromagnetically isolated core having a winding formed thereon and a rotor position sensor.

15. A rotary electric motor comprising:

a permanent magnet rotor having a plurality of permanent magnets disposed in an annular ring configuration; and

a stator coaxial with the rotor and separated therefrom by an axial air gap;

wherein the stator comprises a plurality of independent stator units, each of the units comprising a ferromagnetically isolated core having a winding formed thereon, circuitry for controlling energization of the winding, a rotor position sensor, and a power supply.

16. A rotary electric motor as recited in claim 15, wherein the rotor surrounds the stator.

17. A rotary electric motor as recited in claim 15, wherein said circuitry comprises:

electronic switches connected to the power source and the respective electromagnet winding; and

a switch driver responsive to a controller for applying driving pulses to the switches to apply current pulses from the power source to a winding of the electromagnet.

18. A rotary electric motor as recited in claim 16, wherein each of the units is a structurally self-contained component.

19. A stator for a rotary electric motor having an outer permanent magnet rotor, said stator having an annular ring construction encompassed within the rotor and separated therefrom by a radial air gap, and comprising:

a plurality of ferromagnetically isolated core segments having respective coils wound thereon to form stator windings, said core segments

having an outer radial periphery at the air gap and an inner radial periphery defining a volume within which substantially no flux traverses; and

a non-ferromagnetic support structure for containment of said core segments in ferromagnetic isolation from each other and for supporting a plurality of separate power modules, each of said modules corresponding to a respective stator electromagnet for providing winding energization current thereto.

20. A stator as recited in claim 19, wherein said non-ferromagnetic support structure comprises:

a generally circumferential sleeve portion; and

a plurality of spine members each integrally formed at a first end with said sleeve portion and adapted to be fixed to a stationary shaft at a second end, whereby said sleeve is positioned at a fixed radial distance from said shaft and coaxial therewith.

21. A stator as recited in claim 20, wherein said sleeve portion comprises a plurality of generally parallel ribs on an outer surface thereof to form slots; and each of said core segments comprises:

a pair of salient poles; and

a linking portion joining the poles, said linking portion configured to mate with one of said slots;

whereby said core segments are slideably engageable with and slideably removable from said slots.

22. A stator as recited in claim 21, wherein said sleeve portion comprises a plurality of generally parallel ribs on an inner surface thereof to form slots for slideably receiving said power modules.

23. A stator as recited in claim 22, wherein the outer surface ribs are generally in alignment with the inner surface ribs and the sleeve portion between an adjacent set of ribs comprises a cutout for permitting electrical connection between a power module and a stator winding.